

A METHOD OF IDENTIFICATION AND DESCRIPTION OF SUGAR CANE VARIETIES, AND ITS APPLICATION TO TYPES GROWN IN PORTO RICO.

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The number of varieties of sugar cane (*Saccharum officinarum*) is increasing rapidly,* and for this reason it is desirable to have a method of describing and identifying them. In some cases the points of difference are easily seen, but usually this is not so. This may be due to any of the following reasons: first, that there is a wide range of variation within the varieties, so that, as a consequence, the type is not represented in a single stalk, or in a single plant; second, that a large number of varieties tends to make the differences between some of them very slight; and third, that the differences are quantitative variations of characters common to all, and not the addition of definite new characters. The distinguishing marks are not always found on all the stalks. The type is in many cases difficult to determine, and although two varieties grown side by side may be seen to be distinctly different, it is not always easy to state wherein the differences lie.

Cane varieties vary widely in economic characters as well as in appearance. These characters are yield of cane, sugar content, milling quality, resistance to diseases, resistance to unfavorable conditions for growth, and so forth. Some varieties are much better suited to certain localities than others, and in Porto Rico it may be said that the four kinds of cane extensively cultivated are most commonly grown in more or less well-marked regions. This seems to be largely due to soil and climatic conditions, although it is difficult to state definitely, in every case, the exact factors which control their distribution.

THE PARTS OF THE SUGAR-CANE PLANT.

The sugar cane belongs to the grass family, or *Gramineae*, sub-family *Poaceoideae*, tribe *Andropogoneae*, and genus *Saccharum*. The stems are unbranched and solid. The leaves are alternate and are

* The increase in the number of varieties is a result of breeding, conducted for the purpose of securing superior kinds. This is being done in practically all cane-producing countries. It was commenced in Java in 1887 and in the British West Indies in 1888, and was taken up on account of the advance made by the sugar beet industry in competition, and an apparent deterioration of the standard varieties of cane.

deciduous, with the apparent exception of certain varieties whose leaves adhere to the stalk after they have become dry. There is a bud at each node at the place of attachment of the leaf-sheath. The inflorescence is a many-flowered panicle. The spiklets are one-flowered, in pairs on an articulate rachis and are enveloped in long, silky hairs.

The cane, in common with many other grasses, is propagated by the development of rhizomes from underground buds, by the growth of buds of the stems when they come in contact with the moist soil, and by means of true seed. A stool of cane may be large or small, and may reproduce itself by rhizomes a greater or fewer number of years, depending on the tenacity of the variety and fertility of the soil.

The most important differences for purposes of identification are variations in the parts of the stalk. Differences in floral parts cannot well be used, because many varieties do not blossom, and because the period of flowering lasts only a few weeks. The stalk is the part of commercial importance and it is often desired to identify varieties by the stalk alone. However, the characters of the leaf are sometimes distinctive and may be used in identifying standing cane. More or less distinct differences are seen in the two parts of the leaf, the leaf-blade and the leaf-sheath.

The Stalk.—Stalks of different ages are usually found in a single stool, due to the fact that the buds from which they develop do not all start at the same time.* As stalks change in appearance towards maturity, neither very young stalks, nor those completely mature are most typical of a variety. The appearance of the stalk is also affected by its state of vigor, due to soil or climatic conditions. For example, a prolonged drought causes the internodes to grow short, whereas favorable moisture conditions produce long internodes and larger and plumper buds. A stalk of cane is composed of nodes, internodes, and buds, and these parts show characteristics which aid in distinguishing one variety from another.

The Internode varies in average length, diameter, and shape, being often nearly round, but frequently more or less flattened, sometimes tumid, and sometimes constricted, or larger on one side or at one end than at the other. In many varieties the internodes are more or less distinctly furrowed on one side, the furrow varying in length, depth, and width.

* The cane has a tendency to mature most rapidly in the fall and winter. The blossoming period is in November and December, and after blooming it comes to maturity more quickly, unless the occurrence of heavy rains retards ripening; but new stalks may appear at different times during the growth of the cane, and therefore the state of maturity of any stalk depends largely on its age.

The node varies mainly in form and size. The leaf-scar varies more or less in shape and prominence, and it is sometimes beset with short, stiff hairs. It divides the node into two parts; the part above the leaf-scar consisting of a band or ring, which varies in width and in form, and has many rudimentary roots, there being differences in the number, arrangement, and general appearance of these roots. The portion of the node below the leaf-scar is a more or less depressed ring extending around the stalk.

The Bud.—This usually shows greater varietal differences than the other parts of the cane. Buds vary in length, width, prominence, and shape. The outside scales show differences in shape, size, and texture; their outer edges form a flattened margin which varies in width and in form. Buds are more or less acute-pointed and sometimes bearded, or hairy.

The general characters of the stalk are its color, length, diameter, shape, and amount of glaucousness, or "bloom."

The Foliage, as a whole, varies in color and in relative abundance. The leaf-blade varies in length, width, shape, position, and color. The leaf-sheath shows differences mainly in shape, color, vestiture and tenacity to the stalk. At the place of union of sheath and leaf there are often characteristic differences. The edges of the sheath, just below the point of union of sheath and leaf, have appendages or "auricles," which vary in size and shape. The surface and edges of leaf and leaf-sheath also vary in amount and character of their vestiture.

TERMS USED IN DESCRIBING CANE VARIETIES.

It is necessary to take into consideration variations which exist within the varieties in making descriptions, as it is not always possible to find distinguishing, and at the same time plainly evident marks, so that usually the type must be gotten from several canes of the variety. Average canes should be described, the extreme variant forms being noted but given minor consideration. The most marked characteristics and their range of variability can be remembered for purposes of identification.

Special terms are used in this paper to describe various parts of the cane, as follows. The habit of the plant is described as erect, inclining, reclining, recumbent, or spreading. The term spreading indicates a tendency of the clump to recline in all directions from its center. The term staggered, as applied to the internodes, means alternating in their main axes, from forward to backward and vice versa. The term tumid means enlarged or swollen. "Shoulder"

is applied to a sudden increase in size, or an offset. The furrow is a channel sometimes extending up from the point of attachment of the bud, for all, or a part, of the length of the internode. Barbate signifies bearing hairs, or bristles, in a tuft, like a beard. Barbellate means beset with short, stiff hairs. The term margin is applied to the flattened edge of the bud, formed by the edges of the outside scales. Lobes are expanded areas of the lower part of the margin. Buds are described as prominent when they project from the stalk, depressed when the point is turned down upon the stalk, and appressed when flattened against it. The throat of the leaf-sheath is the region adjacent to the place where it joins the blade. The ligula is a membranaceous appendage of the leaf-sheath, extending up from the point of union of the sheath and blade. The auricles are lateral appendages of the leaf-sheath, just below the point of union with the leaf. Setae are hairs, or bristles, usually rigid and sharp pointed, but sometimes soft, which are often, but not always, found on the back of the leaf-sheath. The term vestiture applies to the setae or hairs occurring on the leaf-sheath or at its throat.

DESCRIPTION OF VARIETIES.

Following are descriptions of some of the cane varieties which have been under trial at this Station. The purpose is to show the application of a method used in identifying and describing varieties, as well as to give descriptions of some of the most important kinds in Porto Rico. The names by which they are known here may be different, in some cases, from their original names, as many of them came to us indirectly. The descriptions apply to the canes known by these names on this Island.

Otaheite.—Habit erect to reclining. Length medium. Diameter medium to large. Shape of stalk curved. Color greenish yellow, a glaucous ring on the lower half of the node. Internodes varying much in shape; typically rather tumid, but sometimes with sides straight, and when tumid most so on the side opposite to the one which bears the bud; somewhat flattened, usually more or less staggered; furrows medium to shallow. Nodes medium size, longest on the bud side; leaf-scar set more or less oblique and projecting somewhat prominently from beneath the bud; the portion above the leaf-scar about the same diameter as the internode above, except when the latter is tumid; the depressed ring, forming the portion below shallow; rudimentary roots in two or three rows. Buds typically sub-elliptical to ovate in outline but varying in size and in rela-

tive length and width; apex semi-elliptical to acute; margin narrow and conforming to the shape of the bud; no prominent lobes; sometimes hairy on the sides and bearded near the apex. Foliage medium abundant, light green in color. Leaf of medium width and length, tapering into a long and fine point. Leaf-sheath rather flattened at the throat; auricles medium to large, often long and acute-pointed on one or both sides of the stalk; ligula medium length, with the upper edge depressed in the center. Vestiture of leaf-sheath many setae which are stiff and not closely appressed. Vestiture of throat of sheath a small amount of medium fine hairs on or adjacent to the auricles. Most important distinguishing characters shape of the buds and of the internodes.

Rayada.*—Habit erect to recumbent. Length medium. Diameter variable but averaging about medium. Shape of stalk more or less curved. Color longitudinally striped with reddish-purple and light green, the stripes varying in width with different stalks and different internodes; more or less glaucous. Internodes medium to short, slightly flattened, typically plump, and more or less tumid on the side opposite the one on which the bud occurs, sometimes straight-sided, often staggered; furrow medium to shallow but usually broad. Nodes medium size; the portion above the leaf-scar often a little smaller in circumference than the internode, and usually a slightly projecting ring at the dividing line of the node and the internode above; the depressed ring forming the portion below typically deep, especially below the bud; the leaf-scar projecting from beneath the bud; rudimentary roots in about three rows. Buds varying in size and in relative length and width, typically broadly ovate-acuminate to broadly ovate in outline, sometimes obtuse-angular; usually plump; point rounded to medium acute; margin medium to wide, typically with medium to large lobes on the sides, often bearded at the point. Foliage abundant, the dry leaves also retained far down on the stalk, medium green in color. Leaf medium width, medium length, tapering into a long point. Leaf-sheath flattened laterally; auricles medium to small, sometimes pointed on one side of the stalk; ligula medium length, with the upper edge rounded in outline. Vestiture of leaf-sheath a few short setae in a line on the back. Vestiture of throat of sheath medium coarse hairs on, or adjacent to, the auricles and on the edges of the base of the leaf, also sometimes pubescent on the surface of the base of the leaf. Most important distinguishing characters color and the shape of the buds.

* This is the striped cane which is widely cultivated on this Island. It is apparently closely related to the *Crystallina* variety.

Crystallina.—Habit erect to recumbent. Diameter medium. Shape of stalk usually curved. Color varying from shades of greenish-red to straw color, sometimes tinted with violet or purple; very glaucous. Internodes varying in length, but averaging about medium; varying also in shape, often tumid on the side opposite the one on which the bud occurs, typically plump, and flattened laterally; furrow medium depth. Nodes medium size, typically larger in the upper part; the lower portion a distinctly depressed ring, which is deepest below the bud; the leaf-scar projecting prominently from beneath the bud, but adhering closely to the stalk on the opposite side; rudimentary roots in three or four rows. Buds varying in length and width, usually plump; typically broadly ovate-acuminate to triangular, with a margin medium to wide; sometimes broadly ovate or semi-elliptical; lobes typically distinct; may or may not start to expand on the standing cane. Foliage abundant, some of the dry leaves also adhere to the stalk, medium green in color. Leaf medium width, medium length, tapering into a long, acute point. Leaf sheath somewhat flattened laterally at the throat; auricles medium size; ligula medium length, with the upper edge rounded in outline, or occasionally slightly depressed in the center. Vestiture of leaf sheath a few setae in a line on the back. Vestiture of throat of sheath medium coarse hairs on auricles, adjacent edges and face of the leaf, and sometimes fine hairs on the surface of the base of the leaf. Most important distinguishing characters color and the form of the internodes and buds.

Cavengerie.—Habit erect to reclining. Length medium. Diameter medium. Shape of stalk more or less curved. Color dark wine to greenish-red, with faint greenish to bronze longitudinal stripes; the lower part of the node more or less glaucous. Internodes nearly round in cross-section, medium to long, typically almost straight-sided, but sometimes inclined to be tumid in the lower half; often more or less staggered; furrow very shallow. Nodes small; the leaf-scar often oblique, usually a slightly prominent ring at the upper limit of the node; the depressed ring forming the portion of the node below narrow and shallow; two, to occasionally three, rows of rudimentary roots. Buds usually dark in color, typically plump and very short, with the margin scarcely perceptible, and the point round and obtuse, set in a cavity of the stalk; but sometimes longer and the point more acute. Foliage abundant, medium green in color. Leaf medium width, medium to short, semi-erect, tapering to a fine point rather abruptly. Leaf-sheath slightly flattened at the throat; color reddish green, striped with light, longitudinal stripes; auricles small; ligula medium to narrow, turned in toward the stalk, and

with the upper edge depressed in the center. Vestiture of leaf-sheath many sharp, stiff setae. Vestiture of throat of sheath straight, rather short hairs on the auricles, adjacent edges of the leaf and leaf-sheath, and sometimes on the face of the base of the leaf. Most important distinguishing characters color, striped leaf-sheath, and form of the buds.

Yellow Caledonia.—Habit erect. Length long. Diameter above medium. Shape of stalk straight. Color greenish-yellow, tinged with red on the upper internodes and where exposed to the sun; with fine, dark-colored cracks in the epidermis; more or less glaucous on the lower part of the node. Internodes long and quite uniform; typically straight-sided, but sometimes slightly constricted and sometimes slightly sub-conical; no furrow. Nodes rather large; the portion above the leaf-scar long and about the same diameter as the internodes; about four rows of rudimentary roots; leaf-scar projecting prominently from beneath the bud. Buds usually small but uniform, about as broad as long, typically ovate to sub-elliptical in outline, plump and with a margin narrow but uniform as to width, and following the shape of the bud; scales of fine texture; bearded at the tip and sometimes pubescent on the sides. Foliage abundant, green leaves inclined to adhere to the stalk rather far down, but the dry leaves are shed; medium dark in color. Leaf broad, long, tapering medium abruptly into a point. Leaf-sheath large in circumference at the throat, color light green with sometimes a pinkish tinge; auricles small; ligula medium length, with the upper edge depressed in the center. Vestiture of leaf-sheath a few setae in a line on the back. Vestiture of throat of sheath short hairs on the auricles, adjacent edges and face of the base of the leaf, and sometimes back of the ligula; also sometimes finely pubescent on the face of the base of the leaf. Most important distinguishing characters color, cracks in the epidermis, and form of the internodes.

B-347.—Habit erect to reclining. Length medium to long. Diameter medium to large. Shape of the stalk usually straight. Color yellowish-green, with a tinge of red on the upper internodes; more or less glaucous; marked with irregular, light-colored spots, apparently caused by a loss of the cuticle. Internodes slightly flattened, medium length, usually staggered; sides sometimes straight but usually more or less tumid, mainly on the side opposite the one on which the bud grows. Nodes medium to large; the leaf-scar projecting out a little on all sides; above the leaf-scar often a little smaller than the portion of the internode just above it; rudimentary roots two to five rows. Buds typically long in comparison to width,

ovate to oval in outline, with the point extended flat against the cane; margin narrow, the point of the margin typically long and semi-elliptical in shape. Foliage medium in amount, medium green in color. Leaf of medium width, medium to short, sub-erect, edges having a tendency to curl. Leaf-sheath flattened laterally at the throat, glaucous; auricles medium size; ligula medium to short, with the upper edge usually depressed in the center. Vestiture of leaf-sheath many long and rather soft setae. Vestiture of throat of sheath medium abundant, long, rather soft hairs on the auricles, and adjacent edges and face of the leaf, and sometimes behind the ligula; also sometimes pubescent on the face of the base of the leaf. Most important distinguishing characters the form of the buds, curling of the leaf, and light colored spots on the internodes.

B-3412.—Habit erect to inclining. Length long. Diameter medium to small. Shape of stalk straight to slightly curved. Color greenish-red but varying in redness with amount of sun-exposure; a glaucous ring on the node below the leaf-scar. Internodes medium to long, nearly round in cross-section, typically straight or slightly depressed on the side above the bud but tumid on the opposite side; furrow just perceptible. Nodes medium size, typically larger above the leaf-scar than below it, slightly longer on the side of the bud; about three rows of rudimentary roots. Buds typically having started to expand, projecting through the outer scales and standing out from the stalk; before starting typically semi-elliptical to broadly ovate in outline, plump, adhering closely to the stalk, having a margin of medium width, lobes inconspicuous. Foliage rather less than medium, medium to dark in color. Leaf narrow, medium length, tapering into a long point. Leaf-sheath nearly round at the throat, often reddish in color; auricles medium size; ligula medium to short, with the upper edge rounded in outline. Vestiture of leaf-sheath many medium stiff setae. Vestiture of throat of sheath medium coarse hairs on the auricles and sometimes extending onto the edges and surface of the base of the leaf. Most important distinguishing characters color and the shape of the buds and the internodes.

B-109.—Habit erect to inclining. Length medium to long. Diameter medium to large. Shape of stalk more or less curved. Color greenish-yellow, with a glaucous ring below the leaf-scar. Internodes medium length, nearly round in cross-section; typically nearly straight-sided, but sometimes slightly staggered, and then slightly tumid on the side opposite the one on which the bud occurs; furrow not perceptible, or very shallow. Nodes medium size; above the leaf-

scar about as large or larger than the internodes, usually a prominent ring at the upper limit of the node; two to three rows of rudimentary roots. Buds typically variable in size and shape and more or less triangular in shape, usually short for their width, sometimes having the appearance of being five-sided; margin typically narrow and uniform in width with the sides of the bud, edges either straight, curved or irregular; lobes small or none. Foliage abundant; retained well down on the stalk, including some of the dry leaves; medium to dark in color. Leaf medium to broad, medium length, tapering into an acute point of medium length. Leaf-sheath almost round at throat, glaucous; auricles small, sometimes long-pointed on one side of the stalk; ligula medium to short, with upper edge rounded in outline. Vestiture of leaf-sheath a few setae which are short and soft. Vestiture of throat of sheath medium coarse hairs on the auricles, edges and surface of base of the leaf, and sometimes a few extending to the area behind the ligula. Most important distinguishing characters color and the form of the internodes and buds.

B-208.—Habit inclining to reclining. Length medium to short. Diameter medium to large. Shape of the stalk usually curved. Color medium green, more or less glaucous. Internodes nearly round in cross-section, typically short and tumid, and with a prominent shoulder on the side opposite the one on which the bud occurs; furrow very shallow. Nodes small; the portion above the leaf-scar a little longer, and larger in circumference than that below; the depressed ring forming the portion below the leaf-scar medium depth but narrow, deepest below the bud. Two or three rows of rudimentary roots. Buds typically having started through the scales and projecting out from the stalk in a globoid to conical point; before starting short and swollen; when very young typically flat, very broad and ovate-cuspidate in outline, with the margin extending across the top or rather than on the sides; lobes typically well-marked. Foliage medium in amount, rather dark in color. Leaf medium to short, broad, growing semi-erect, tapering medium abruptly into a point. Leaf-sheath broad, almost round at the throat, light green to reddish-green in color; auricles medium to small; ligula medium length, with the upper edge slightly depressed in the center. Vestiture of leaf-sheath many long, medium stiff setae, not closely appressed. Vestiture of throat of sheath medium soft hairs on the auricles and edges of the base of the leaf, and more or less on the adjacent area of the face of the leaf. Most important distinguishing characters form of the internodes and buds.

B-6450.—Habit reclining. Length medium. Diameter medium.

Shape of stalk more or less curved. Color green when young, yellowish-green when mature; the surface is smooth and sometimes glossy on the young stalks but when old it often contains fine cracks; usually glaucous on the lower portion of the node. Internodes medium length; typically variable in shape, but tumid on the side opposite the bud and more or less staggered; furrow broad and shallow, deepest underneath the bud. Nodes medium length; the depressed ring forming the portion below the leaf-scar medium width and depth, deepest immediately below the bud; rudimentary roots far apart, white, in two to four rows. Buds medium size, typically ovate to triangular in outline, rather flat when young; margin usually narrow and conforming to the shape of the bud; sometimes pubescent at the base. Foliage abundant, medium green in color. Leaf of medium length and width, tapering into a medium long point. Leaf-sheath flattened laterally at the throat; auricles medium to large, often a little more pointed on one side of the stalk than the other; ligula medium to long, with the upper edge rounded to obtuse-pointed in the center. Vestiture of leaf-sheath rather fine setae. Vestiture of throat of sheath medium soft hairs on the auricles and edges of the base of the leaf, and sometimes a few in adjacent area behind the ligula. Most important distinguishing characters color and shape of the buds and the internodes.

B-7245.—Habit erect. Length medium. Diameter medium to large. Shape of stalk straight. Color green to yellowish-green, some of the upper internodes slightly reddened; the lower portion of the node glaucous. Internodes medium to long, nearly round in cross-section, almost straight-sided, but the shorter internodes are tumid and the longer ones typically slightly constricted in the lower half on the bud side, or all around, making the upper half the largest in circumference; furrow broad but usually shallow. Nodes medium to large, the portion above the leaf-scar short on the side opposite the bud; typically smaller in diameter above than below; the upper portion increasing in size from below upward, and forming a prominent ring at the upper extremity of the node; the leaf-scar and the depressed ring forming the portion below it oblique; two to three rows of rudimentary roots, which are conspicuous. Buds varying in size, generally adhering closely to the stalk, usually about as broad as long; typically ovate to broadly ovate in outline, with the point rounded and the margin medium to narrow; sometimes bearded at the apex. Foliage abundant, medium green in color. Leaf medium to wide but variable, medium length, tapering into a medium to long point. Leaf-sheath distinctly flattened laterally at the throat; auri-

cles medium to large, those on one side of the stalk sometimes acute-pointed, and on the young sheaths, overlapped by the others; ligula medium to short, with the upper edge sub-elliptical, to obtuse-pointed in the center. Vestiture of leaf-sheath very long, sharp and prominent setae. Vestiture of throat of sheath medium soft hairs on the auricles, edges of the leaf, and a few back of the ligula. Most important distinguishing characters the shape and size of the internodes and the buds.

B-1809.—Habit erect. Length long. Diameter large. Shape of stalk straight. Color medium green when young, but becoming yellowish-green with age; a glaucous ring on the node below the leaf-scar, which becomes dark with the aging of the stalk. Internodes medium to long, flattened; typically nearly straight-sided or largest in diameter just above the node, where there is a prominent ring, and on the side opposite the bud a shoulder; furrow broad and rather deep, but narrower and shallower toward the top of the internodes. Nodes rather large; typically smaller below the leaf-scar than above, and increasing in size above until the lower limit of the internode is reached; two or three rows of rudimentary roots; the depressed ring forming the portion below the leaf-scar shallow on the side opposite the bud but deeper immediately below it. Buds typically long and more or less triangular in shape with the point either broad or acute; but sometimes about as broad as long, more or less ovate and acute-pointed; adhering rather closely to the stalk; often increasing in length on the standing stalk, but not usually projecting much through the scales; margin medium to narrow, and conforming to the shape of the bud, or forming small lobes at the sides; usually bearded near the point. Foliage abundant, medium green in color, many dry leaves also retained. Leaf medium to broad, medium length, erect growing. Leaf-sheath somewhat flattened at the throat, glaucous; auricles medium to small; ligula medium length, with the upper edge usually depressed in the center. Vestiture of leaf-sheath medium stiff setae on the back. Vestiture of throat of sheath medium long hairs on the auricles and edges of the base of the leaf, and sometimes a few on the adjacent areas of the face of the base of the leaf; sometimes slightly pubescent on the face of the base of the leaf. Most important distinguishing characters the shape and size of internodes, buds, and leaves.

B-3859.—Habit inclining. Length medium. Diameter medium. Shape of stalk more or less curved. Color wine to greenish-wine; a glaucous ring on the lower half of the node. Internodes medium length, nearly round in cross-section, varying in shape with different

stalks, sometimes straight-sided, but typically tumid in the lower part, especially on the side opposite the bud, and sometimes constricted above; more or less staggered; furrow shallow. Nodes rather long, considerably longer on the side to which the bud is attached; leaf-scar usually oblique; the portion above typically larger in diameter than that below; two or three rows of rudimentary roots; the depressed ring forming the portion below the leaf-scar medium depth and narrow. Buds typically expanded and projecting out from the stalk, but before starting adhering closely to the stalk and typically ovate to oval in outline; margin narrow and conforming to the shape of the bud, bearded at the point. Foliage abundant, medium green in color. Leaf medium width, length medium to short, growing erect, tapering rather abruptly to a fine point. Leaf-sheath flattened at the throat, reddish in color; auricles medium size but sometimes acute-pointed on one side of the stalk; ligula medium width, with the upper edge rounded to obtuse-pointed in the center. Vestiture of leaf-sheath a few short and fine setae on the back, rather closely appressed. Vestiture of throat of sheath medium long and coarse hairs on the auricles, the adjacent edges of the leaf, and sometimes a few behind the ligula. Most important distinguishing characters shape and size of the internodes and the buds.

B-6292.—Habit erect. Length long. Diameter small. Shape of stalk straight. Color light green to reddish-green, a glaucous ring on the node below the leaf-scar. Internodes almost round in cross-section, usually tumid on the side opposite the bud and slightly depressed on the bud side; furrow, when present, broad and shallow. Nodes medium size, longest on the bud side; the depressed ring forming the portion below the leaf-scar shallow. Buds usually having commenced to expand and standing out from the stalk, the shoot being acute-pointed and extending through the scales; when not having started to develop shoots the buds are typically broadly semi-elliptical in outline, with a margin of medium width. Foliage medium to abundant, medium green in color. Leaf narrow and long, tapering into a long point. Leaf-sheath slightly flattened at the throat; auricles large and obtuse-angular, except occasionally on one side of the stalk they are semi-acute pointed; ligula medium to long, with the upper edge rounded in outline. Vestiture of throat of sheath medium coarse hairs on the auricles and adjacent edges and surface of the leaf. Most important distinguishing characters the form of the buds and the long, slender stalk.

B-1753.—Habit erect to inclining. Length long. Diameter small. Shape of stalk straight. Color straw color to yellow, a glaucous

ring on the node below the leaf-scar. Internodes nearly round in cross-section, straight-sided or slightly depressed on the side on which the bud occurs, usually largest in diameter at the place of union with the node below; furrow shallow or none. Nodes medium to large; the portion above the leaf-scar long, typically large in circumference and appearing swollen, or expanding from the bottom upward to the lower limit of the internode; leaf-scar close to the stalk on the side opposite the bud but projecting out from beneath the bud; rudimentary roots very close together and in about four or five rows; the depressed ring forming the portion below the leaf-scar shallow. Buds close to the stalk, or slightly prominent; young buds typically flat against the stalk, ovate to acute, and with a narrow margin, uniform with the sides of the buds. Foliage rather scant, the leaves being shed far up on the stalk; light green in color. Leaf narrow, short, growing erect, tapering into a long point, sometimes breaking off at the throat and falling from the sheath. Leaf-sheath nearly round at the throat; auricles medium to large, sometimes long-pointed on one side of the stalk; ligula medium length, with the upper edge rounded in outline. Vestiture of leaf-sheath many soft setae. Vestiture of throat of sheath fine hairs on the auricles and adjacent edges and face of the base of the leaf. Most important distinguishing characters the shape and size of the nodes and buds, and the manner of growth of the leaves.

B-4596.—Habit erect to reclining. Length medium. Diameter medium to large, variable. Shape of stalk usually straight. Color yellowish-green to reddish green, usually more red just above the node, sometimes having spots of reddish-brown; glaucous, especially the lower portion of the nodes; having fine cracks in the epidermis. Internodes medium to long, more or less flattened, often larger above than below the node; typically straight-sided, plump; sometimes slightly tumid, sometimes subconical; often a typical shoulder just above the node on the side opposite the one having the bud; furrow medium depth. Nodes rather short; the depressed ring forming the portion below the leaf-scar distinct; rudimentary roots about two rows. Buds typically large and coarse but varying with the coarseness of the stalk, broad, obtuse to more or less acute pointed; the margin typically wide, with straight edges and large lobes; sometimes broadly ovate-acuminate in outline; occasionally starting and standing out slightly from the stalk but not producing sprouts. Foliage medium in amount, dry leaves readily shed. Leaf medium to broad, medium length, tapering into a point of medium length. Leaf-sheath flattened laterally at throat; auricles medium to small; ligula

medium length, with the upper edge rounded or slightly depressed in the center. Vestiture of leaf-sheath medium stiff, fine and short setae. Vestiture of throat of sheath medium fine hairs on the auricles, and adjacent edges and face of the base of the leaf; sometimes finely pubescent on the adjacent surface of the leaf. Most important distinguishing characters color and the form of the buds and the internodes.

B-376.—Habit erect to recumbent. Length long. Diameter medium. Shape of stalk more or less curved. Color varying from shades of greenish-red to straw color, and sometimes showing violet or purple tints; very glaucous. Internodes varying in length but averaging about medium; also varying much in shape, sometimes straight-sided and sometimes more or less tumid, mainly tumid on the side opposite to the one bearing the bud, typically plump, and slightly flattened laterally; furrow medium depth. Nodes medium size; the depressed ring constituting the portion below the leaf-scar distinct, deepest immediately below the bud; the upper portion usually about the same size as the internode, and often larger than the portion below; the leaf-scar adhering closely to the stalk on the side opposite the bud, but often projecting out prominently from beneath the bud; rudimentary roots three or four rows. Buds varying in relative length and width, usually plump, typically almost as broad as long and broadly ovate-acuminate to triangular in outline, obtuse to medium acute pointed; margin medium width, typically with distinct lobes; may or may not start to expand on the standing stalk. Foliage abundant, medium green in color, some of the dry leaves also adhere to the stalk. Leaf medium width, medium length, tapering into a long point. Leaf-sheath slightly flattened laterally at the throat; auricles medium size; ligula medium width, with the upper edge rounded in outline or sometimes slightly depressed in the center. Vestiture of leaf-sheath a few setae in a line in the back. Vestiture of throat of sheath medium coarse hairs on the auricles, adjacent edges of the base of the leaf, and sometimes fine hairs on the surface of the base of the leaf. Most important distinguishing characters color and the form of the internodes, and the buds.

Seeley Seedling.—Habit erect to inclining. Length long. Diameter medium to small. Shape of stalk slightly curved. Color greenish-red, but varying in redness with the amount of sun-exposure; the depressed ring of the node below the leaf-scar glaucous. Internodes medium to long, almost round in cross-section; typically straight or slightly depressed from the bud upwards, but more or less tumid on the opposite side; furrow just perceptible. Nodes medium size, typically

smaller below the leaf-scar than above it, longer on the side of the bud; about three rows of rudimentary roots. Buds usually having started to expand, projecting through the outer scales and standing out from the stalk; before starting typically semi-elliptical to broadly ovate in outline and adhering closely to the stalk; fairly plump; margin medium in width; lobes inconspicuous. Foliage rather less than medium, medium to dark in color. Leaf narrow, medium length, tapering rather gradually into a point. Leaf-sheath nearly round at the throat, usually reddish in color; auricles medium size; ligula medium to short, with the upper edge rounded in outline. Vestiture of leaf-sheath medium stiff setae. Vestiture of throat of sheath medium coarse hairs on the auricles, and a few extending up onto the adjacent edges and surface of the leaf. Most important distinguishing characters color and the shape of the internodes and the buds.

B-3747.—Habit erect to inclining. Length long. Diameter medium. Shape of the stalk straight. Color yellowish-green to reddish-green; more or less glaucous, especially the depressed ring forming the lower portion of the node. Internodes flattened; typically slightly larger in the upper portion, and with a tendency to be tumid, especially the shorter internodes and on the side opposite to the bud; the side on which the bud occurs is almost straight immediately above the bud, but often a little tumid just below the node; sometimes staggered; furrow rather broad but shallow. Nodes medium size, the portion above the leaf-scar longer on the side on which the bud is attacked than on the opposite; rudimentary roots quite abundant and distinct, in two or three rows; the depressed ring forming the lower portion of the node narrow and shallow; the leaf-scar more or less oblique and projecting from beneath the bud, ciliated with more or less deciduous hairs. Buds large or small, depending on the size of the stalk; often short in comparison with their breadth, triangular to ovate in outline, occasionally long and appearing shrunken; typically obtuse or blunt pointed, and with a narrow margin and having edges conforming to the shape of the bud. Foliage medium in amount, medium green in color. Leaf medium to broad, long, tapering into a long, acute point. Leaf-sheath distinctly flattened laterally at the throat; auricles small; ligula narrow, upper edge either rounded, slightly pointed, or slight depressed in the center. Vestiture of leaf-sheath many rather long and soft setae. Vestiture of throat of sheath hairs on auricles, adjacent edges of leaf, and sometimes a few on the adjacent areas of the face of the leaf. Most important distinguishing characters form of the buds and the internodes, and the ciliated leaf-scar.

B-3750.—Habit erect to inclining. Length medium. Diameter medium. Shape of stalk straight to slightly curved. Color greenish-yellow, sometimes reddened on the upper internodes; glaucous on the lower portion of the node. Internodes medium to long, slightly flattened; typically almost straight-sided, but slightly tumid on the side opposite to the one which bears the bud and a little larger on the upper portion; slightly staggered; furrow shallow or none. Nodes medium to small, the portion above the leaf-scar medium to short and longest on the side on which the bud is attached; two or three rows of rudimentary roots; the leaf-scar and the portion below it usually somewhat oblique; the former projecting prominently from beneath the bud. Buds medium size; typically broadly triangular in outline, having a wide margin with nearly straight edges; young buds more or less broadly ovate; scales of fine texture. The characteristic buds of this variety are those occurring more or less frequently on the upper part of the stalk, the margins having slightly increased in length and width. Foliage medium abundant, medium green in color. Leaf medium width, long, growing semi-erect, tapering into a long point. Leaf-sheath flattened at the throat; auricles small, sometimes acute-pointed on one side of the stalk; ligula short, with the upper edge rounded or slightly depressed in the center. Vestiture of leaf-sheath many setae which are long, rather soft, and not closely appressed. Vestiture of throat of sheath medium coarse hairs on the edges of the base of the leaf and the auricles, and sometimes fine hairs on the surface of the base of the leaf. Most important distinguishing characters the form of the internodes and of the buds.

B-3390.—Habit erect. Length medium to long. Diameter medium. Shape of stalk usually straight. Color reddish-green to green; more or less glaucous. Internodes nearly round in cross-section; sides typically nearly straight, but the longer internodes larger above the node than below it, and sometimes slightly constricted; often curved in above the bud and correspondingly tumid on the opposite side; furrow shallow and inconspicuous. Nodes medium size; rather larger above the leaf-scar than below it and largest on the bud side; below it a depressed ring of medium dimensions; rudimentary roots large and prominent, in two to four rows. Buds rather small, usually adhering closely to the stalk; margin typically sub-ovate to acute in outline of medium width and conforming to the shape of the bud. Foliage medium abundant, medium green in color. Leaf medium to narrow, sub-erect, tapering into a long point. Leaf-sheath somewhat flattened at the throat, slightly glaucous; auricles medium to large; ligula medium in width, with the upper edge

slightly depressed in the center. Vestiture of leaf-sheath none. Vestiture of throat of sheath medium soft hairs on and adjacent to the auricles; also sometimes slightly pubescent on the face of the base of the leaf. Most important distinguishing characters the form of the internodes and the buds.

B-7169.—Habit erect. Length medium. Diameter medium. Shape of the stalk usually straight. Color yellowish-green to reddish-green, having a somewhat glossy surface and sometimes with a few fine cracks in the epidermis; the lower portion of the node sometimes glaucous. Internodes medium length, nearly round in cross-section; typically almost straight-sided but a little tumid on the side opposite the bud; the lower portion often slightly the largest and becoming smaller until the node is reached; furrow none or very shallow. Nodes medium size; almost uniform in length around the stalk, but the portion above the leaf-scar sometimes longer, and that below a little shorter on the bud side, the leaf-scar then being set at an angle; three or four rows of rudimentary roots, which show as white points. Buds regular in shape; typically ovate to acute in outline and acute-pointed; usually flat against the stalk but occasionally slightly prominent; margin narrow, with the edges straight or conforming to the shape of the bud; lobes small; scales of fine texture. Foliage abundant, medium green in color. Leaf medium to narrow, medium length, sub-erect, tapering into a medium long point. Leaf-sheath flattened laterally at the throat; auricles medium to small; ligula medium length, with the upper edge rounded to sub-elliptical. Vestiture of leaf-sheath a band of setae on the back, rather long and medium stiff. Vestiture of throat of sheath medium fine hairs on the auricles, adjacent edges and face of the leaf, and sometimes a few behind the ligula. Most important distinguishing characters color and glossy appearance, and the form of the internodes and the buds.

B-3405.—Habit erect to inclining. Length medium to long. Diameter medium. Shape of stalk nearly straight. Color reddish-green, being reddest in the upper internodes and where exposed to the sun; often glaucous on lower portion of the node. Internodes medium length, slightly flattened, typically slightly tumid on the side opposite the one which bears the bud, and sometimes a little sub-conical; often slightly staggered; furrow shallow but usually broad. Nodes medium size; leaf-scar often oblique and usually projecting prominently from beneath the bud; the portion above the leaf-scar rather long; the depressed ring forming the portion below medium width and shallow, excepting immediately below the bud where it

is deeper; two or three rows of rudimentary roots. Buds typically having started to expand on the standing cane and projecting from the stalk; before starting semi-elliptical to broadly ovate in outline; margin narrow in the young buds but appearing wide in the older ones, typically semi-elliptical pointed; lobes inconspicuous; sometimes slightly barbate at the point and barbellate on the sides. Foliage medium to scant, medium green in color, dry leaves well shed. Leaf medium to narrow, long, tapering into a long and fine point. Leaf-sheath almost round at throat, slightly glaucous; auricles medium to large; ligula medium width, with the upper edge either rounded in outline or slightly depressed in the center. Vestiture of leaf-sheath many setae, which are rather long and medium stiff. Vestiture of throat of sheath long and medium course hairs on the auricles and adjacent edges of the leaf, and sometimes a few on the adjacent areas of the face of the leaf. Most important distinguishing characters the form of the buds and the internodes.

D-117.—Habit erect. Length long. Diameter medium. Shape of the stalk straight. Color light green to yellowish-green. Internodes medium to long, slightly flattened; typically straight on the side opposite to the one on which the bud occurs, but on the bud side largest at the base and extending up nearly straight from that point; sometimes slightly constricted above the enlargement at the base; furrow, when present, shallow but rather broad. Nodes large, typically largest on the bud side above the leaf-scar; often a slightly prominent ring at the line of union with the internode above; leaf-scar projecting prominently from beneath the bud; rudimentary roots many and close together, in three or four rows. Buds typically broadly-ovate to triangular in shape and medium acute-pointed; margin medium to narrow, and uniform in width with the sides of the bud; lobes inconspicuous or none; sometimes bearded at the point and barbellate on the sides. These buds sometimes start to expand on the standing stalk, but they do not become prominent; the sprout from the bud is plump and medium obtuse pointed. Foliage medium in amount, medium green in color, some of the dry leaves are retained. Leaf medium in width, medium length, tapering into a medium long point. Leaf-sheath slightly flattened laterally at the throat; auricles medium size but sometimes long-pointed on one side of the stalk; ligula short, with the upper edge either rounded or slightly depressed in the center. Vestiture of leaf-sheath a few medium soft setae. Vestiture of throat sheath long hairs on the auricles, adjacent edges of the leaf, and sometimes finer hairs on the adjacent surface of the base of the leaf; also more or less pubescent

on the face of the base of the leaf. Most important distinguishing characters the shape of the internodes, nodes and buds.

D-109.—Habit inclining to recumbent. Length medium to long. Diameter medium. Shape of the stalk curved. Color dark purple to greenish-red; abundantly glaucous. Internodes medium to long, slightly flattened; typically tumid, especially so in the lower part, making them sub-conical; furrow shallow or imperceptible. Nodes medium to small, regular in shape; usually as dark or darker than the internodes, when on the lower part of the stalk, but lighter and greener above; two or three rows of rudimentary roots. Buds nearly all having started to expand on the standing stalk; scales usually lighter in color than the shoot; the young buds typically plump, fairly uniform and ovate to oval in outline; margin narrow, and in the young buds, semi-elliptical at the point; having inconspicuous lobes on the sides; slightly bearded at the tip. Foliage abundant, dark in color. Leaf medium to broad, medium length, gradually tapering into a fine point. Leaf-sheath compressed laterally at the throat, reddish in color, very glaucous; auricles medium size, sometimes long-pointed on one side of the stalk; ligula short, with the upper edge more or less pointed in the center. Vestiture of leaf-sheath a few setae in a narrow line on the back. Vestiture of throat of sheath soft hairs on the auricles and adjacent edges of the leaf, and sometimes pubescent on the surface of the base of the leaf blade. Most important distinguishing characters color and the form of the internodes and the buds.

D-625.—Habit erect. Length medium to long. Diameter large. Shape of stalk usually straight. Color light yellowish-green to yellow; reddish brown rings at the upper limit of the nodes, especially on the upper portion of the stalk; the portion of the node below the leaf-scar glaucous. Internodes medium to long, nearly round in cross-section; the sides typically nearly straight but sometimes slightly constricted and sometimes a little tumid on the side opposite the bud; sometimes a little staggered; furrow broad but shallow. Nodes medium to large; the portion above the leaf-scar long and usually as large, or larger, in diameter than the internode above; rudimentary roots rather far apart, in two or three rows; the depressed ring forming the portion below very shallow. Buds large and quite uniform in shape; typically plump and broadly triangular to ovate in outline; margin medium to narrow and conforming to the shape of the bud; often bearded at the apex and barbellate on the sides of the margin. Foliage medium to scant, color medium green. Leaf medium width, medium length, sub-erect, tapering into

a fine point medium abruptly. Leaf-sheath nearly round at the throat; auricles small; ligula medium length, with the upper edge usually rounded, but sometimes slightly pointed, and sometimes slightly depressed in the center. Vestiture of leaf-sheath many soft setae. Vestiture of throat of sheath medium fine hairs on the auricles and adjacent edges of the leaf, and sometimes behind the ligula; sometimes finely pubescent on the face of the base of the leaf. Most important distinguishing characters form and size of the internodes and buds, and the brown ring on the node.

EXPLANATION OF PLATES.

PLATE X.

Fig. 1.—A bud of Yellow Caledonia cane, showing a narrow, uniform margin, without lobes, and a barbate apex. \times about $3\frac{1}{2}$.

Fig. 2.—A bud of B 208, showing a margin with large lobes and a barbate apex. \times about 3.

Fig. 3.—A bud of the same variety, expanded, showing the globoid point. \times about 3.

Fig. 4.—A portion of the leaf-sheath of Cavengerie cane, showing setae. \times about $3\frac{1}{2}$.

Fig. 5.—The ciliated leaf-scar, occurring on B 3747, B 1355 and B 1356. \times about $3\frac{1}{2}$.

PLATE XI.

Fig. 1.—Otaheite. Distinguished by its somewhat tumid internodes and its sub-elliptical to ovate buds. \times about $\frac{3}{8}$.

Fig. 2.—Rayada. Distinguished by its stripes and the broadly ovate to ovate-acuminate buds. \times about $\frac{3}{4}$.

PLATE XII.

Fig. 1.—Crystallina. Distinguished by its glaucousness, its typical plump internodes and its broadly ovate-acuminate to triangular buds. \times about $\frac{3}{4}$.

Fig. 2.—Yellow Caledonia. Distinguished by its almost cylindrical internodes and the fine cracks in the epidermis of the internodes. \times about $\frac{3}{8}$.

PLATE XIII.

Fig. 1.—B 347. Distinguished by its long ovate to oval buds, and the light-colored blotches on the internodes. \times about $\frac{1}{2}$.

Fig. 2.—B 3412. Distinguished by the medium thin stalks and the prominent expanded buds. \times about $\frac{3}{4}$.

PLATE XIV.

Fig. 1.—B 208. Distinguished by its plump internodes, the shoulder above the node, and the expanded, globoid buds. \times about $\frac{5}{8}$.

Fig. 2.—B 6450. Distinguished by the shape of the internodes and the ovate to triangular buds. \times about $\frac{3}{8}$.

PLATE XV.

Fig. 1.—B 3859. Distinguished by the more or less staggered and tumid internodes and the plump, expanded buds. \times about $\frac{3}{8}$.

Fig. 2.—B 4596. Distinguished by its straight-sided, almost cylindrical internodes, and the wide margin and large lobes of the buds. \times about $\frac{5}{8}$.

PLATE XVI.

Fig. 1.—B 3747. Distinguished by the shape of the internodes and its ciliated leaf-scar. \times about $\frac{3}{8}$.

Fig. 2.—B 7169. Distinguished by its glossy surface, the almost straight-sided internodes and the regular, ovate to acute buds. \times about $\frac{3}{4}$.

PLATE XVII.

Fig. 1.—B 3405. Distinguished by its slightly tumid to sub-conical internodes and its broadly semi-elliptical to broadly ovate, usually expanded, buds. \times about $\frac{2}{3}$.

Fig. 2.—D 117. Distinguished by the large nodes, the shape of the internodes and the broadly ovate to triangular buds. \times about $\frac{2}{3}$.

PLATE XVIII.

Fig. 1.—D 109. Distinguished by the tumid or sub-conical internodes and the usually expanded buds. \times about $\frac{3}{8}$.

Fig. 2.—D 625. Distinguished by the thick, erect-growing stalks, its almost cylindrical internodes, the brown ring on the nodes, and the regular, plump broadly ovate to triangular buds. \times about $\frac{2}{3}$.

PLATE X.

CHARACTERS OF VARIETIES OF SUGAR CANE.



Fig. 1.

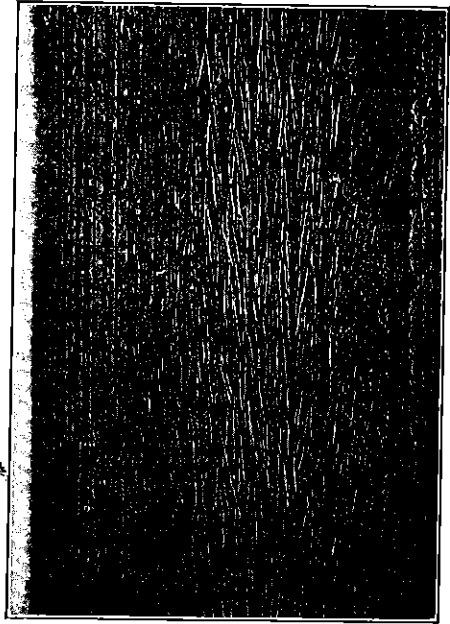


Fig. 4.



Fig. 2.



Fig. 3.



Fig. 5.



PLATE XI.
SUGAR-CANE VARIETIES OF PORTO RICO.

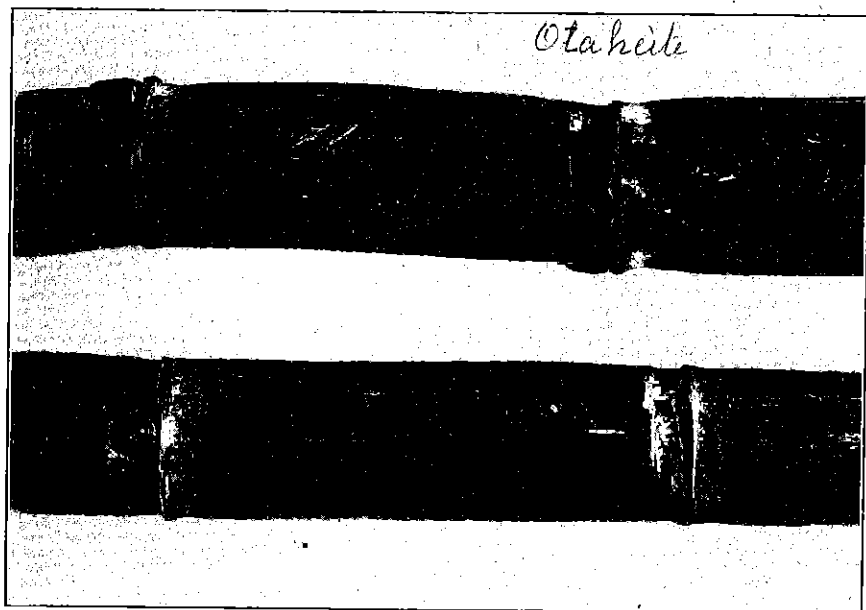


Fig. 2.

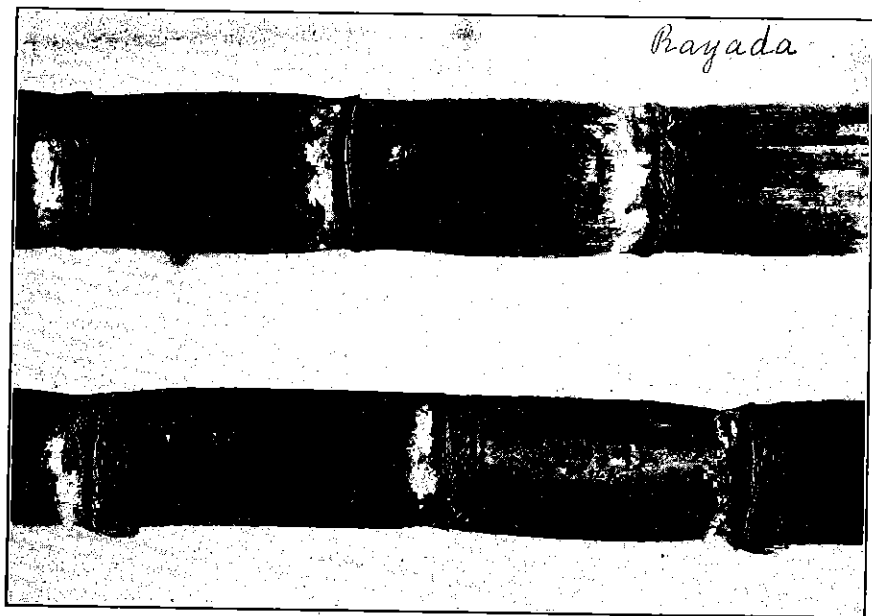


Fig. 1.

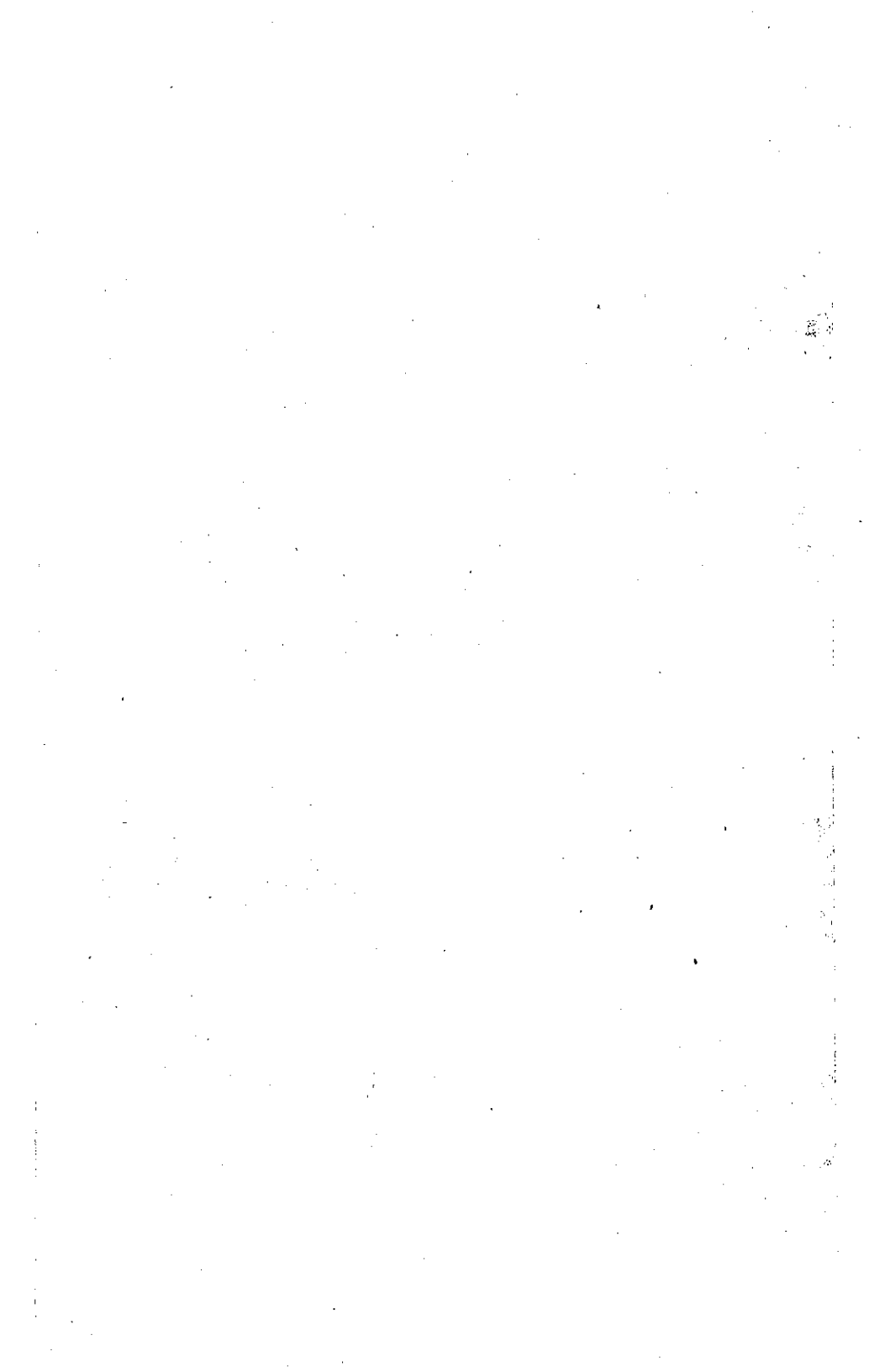


PLATE XII.
SUGAR-CANE VARIETIES OF PORTO RICO.

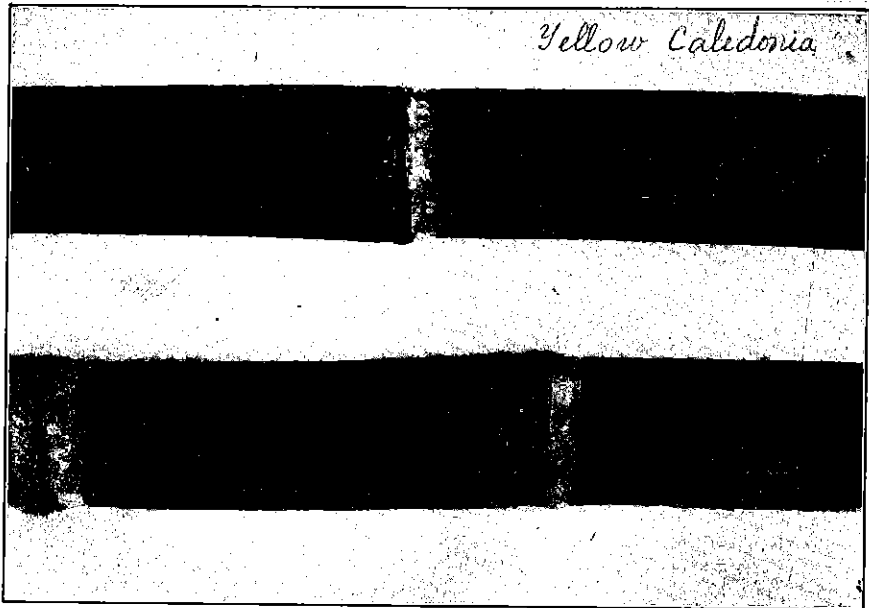


Fig. 2.

X

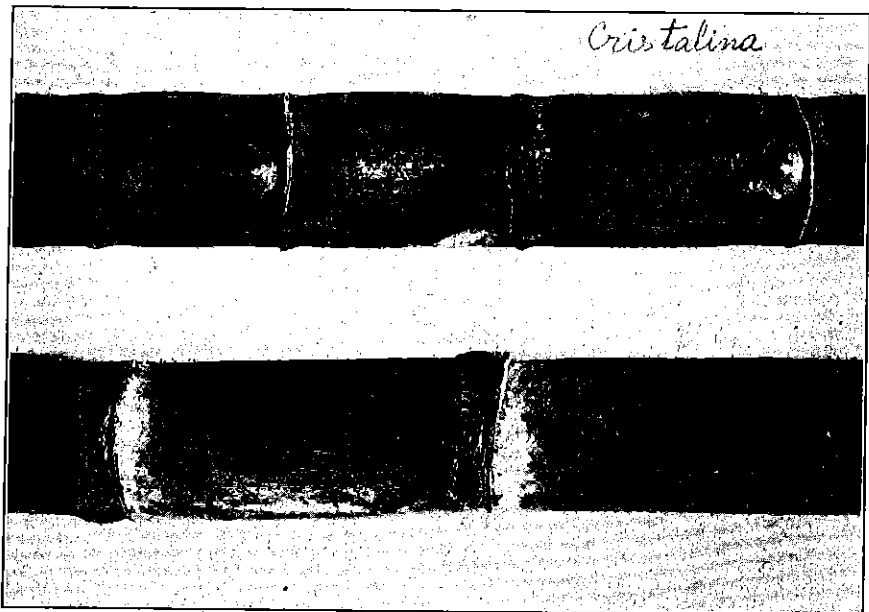


Fig. 1.

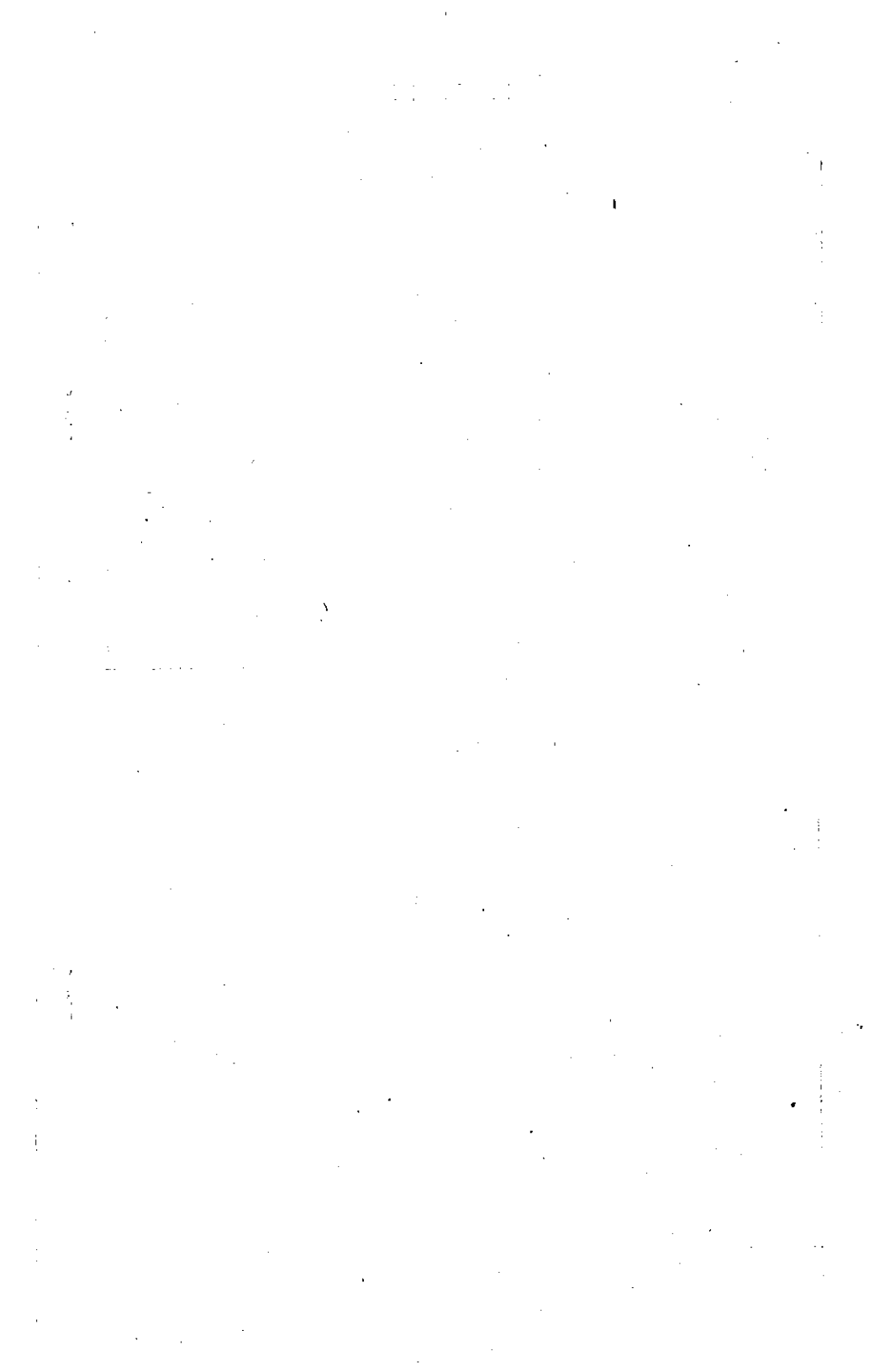
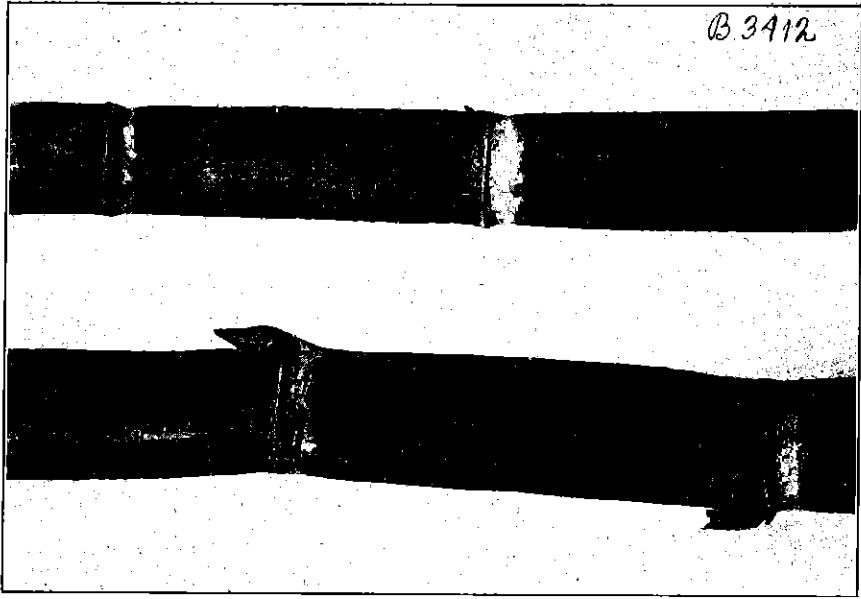
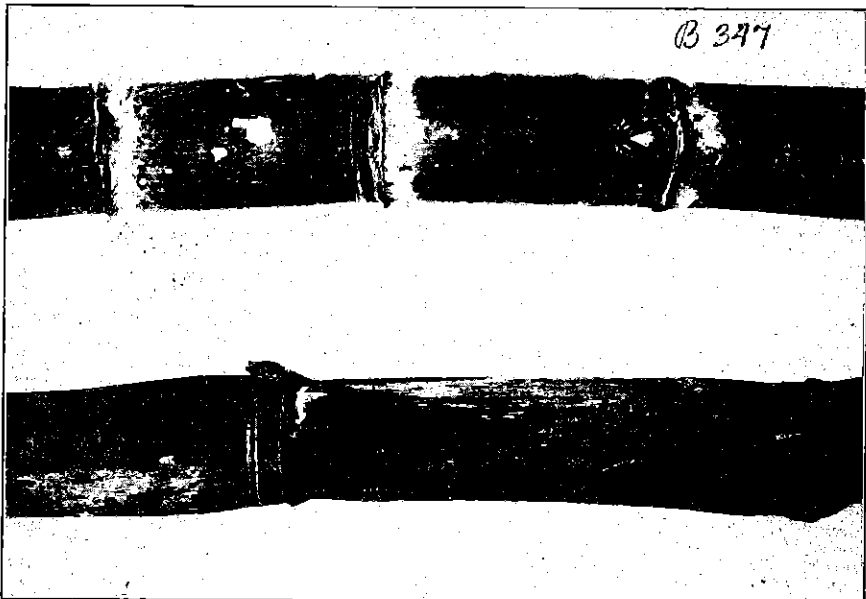


PLATE XIII.
SUGAR-CANE VARIETIES OF PORTO RICO.



✓
X
Fig. 2.



✓
Fig. 1.

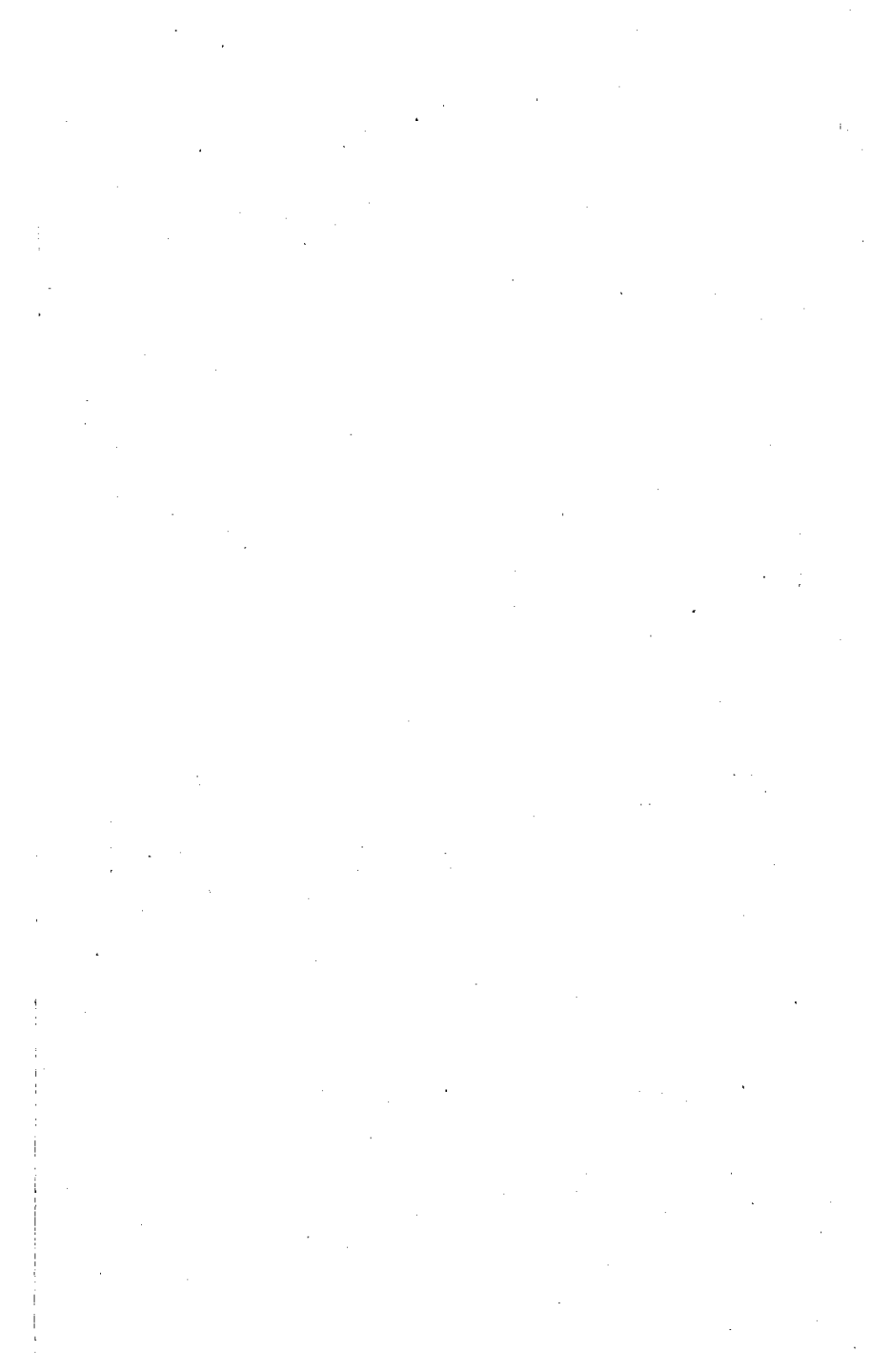


PLATE XIV.
SUGAR-CANE VARIETIES OF PORTO RICO.

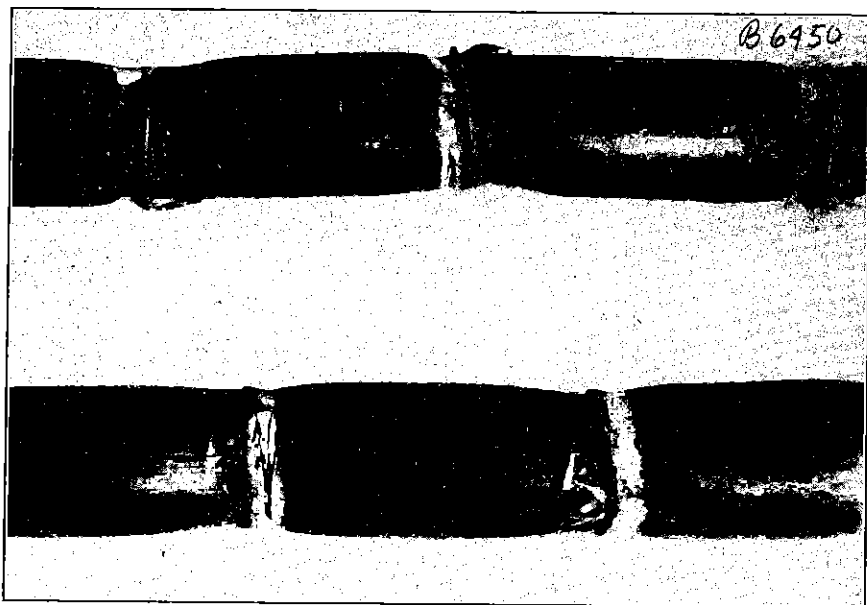


Fig. 2.

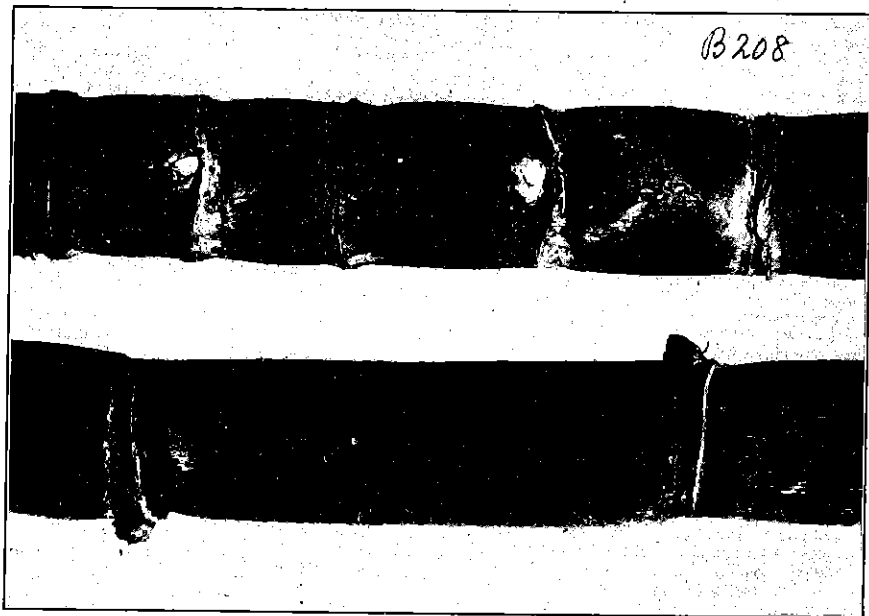


Fig. 1.

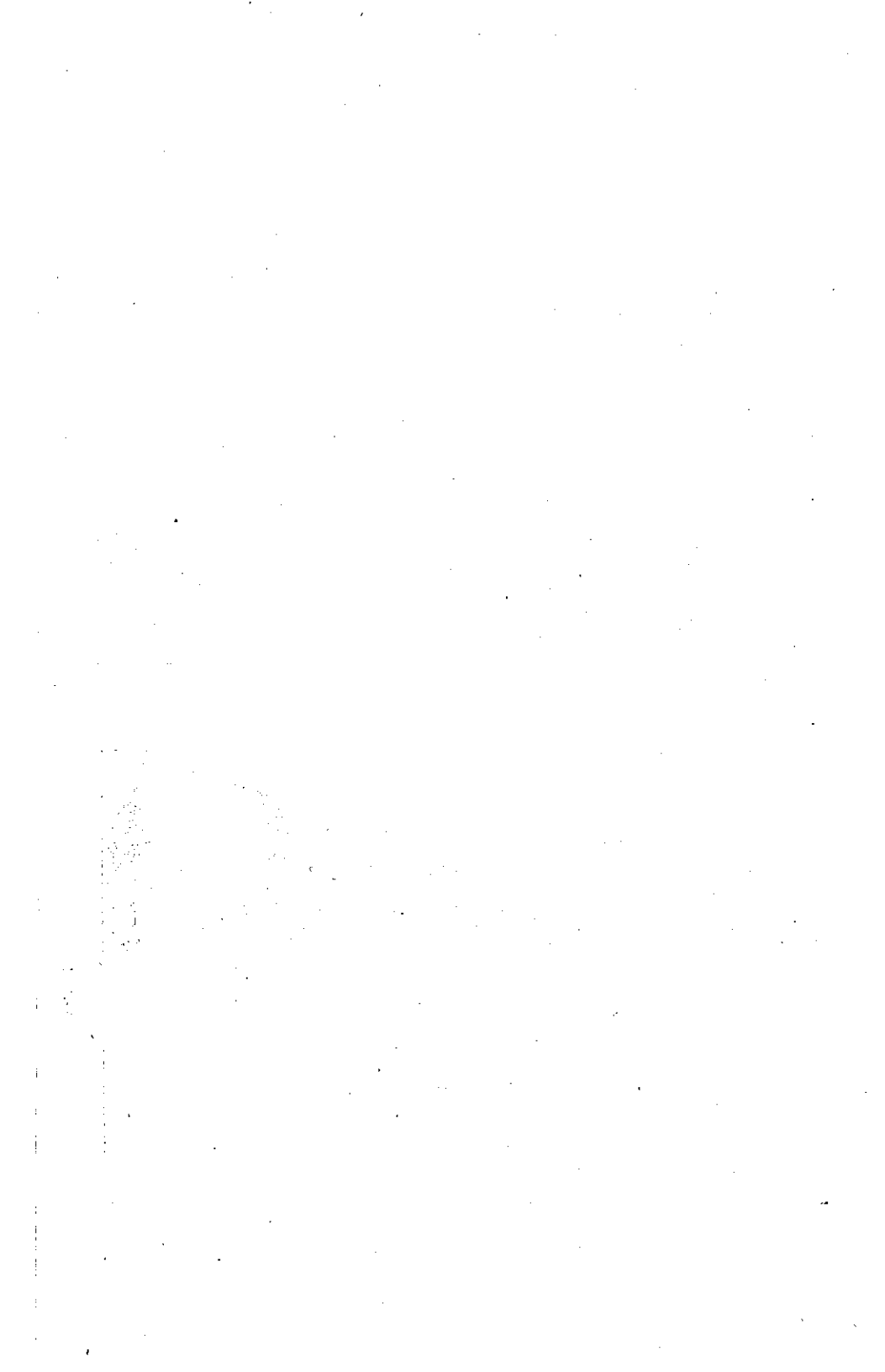


PLATE XV.
SUGAR-CANE VARIETIES OF PORTO RICO.

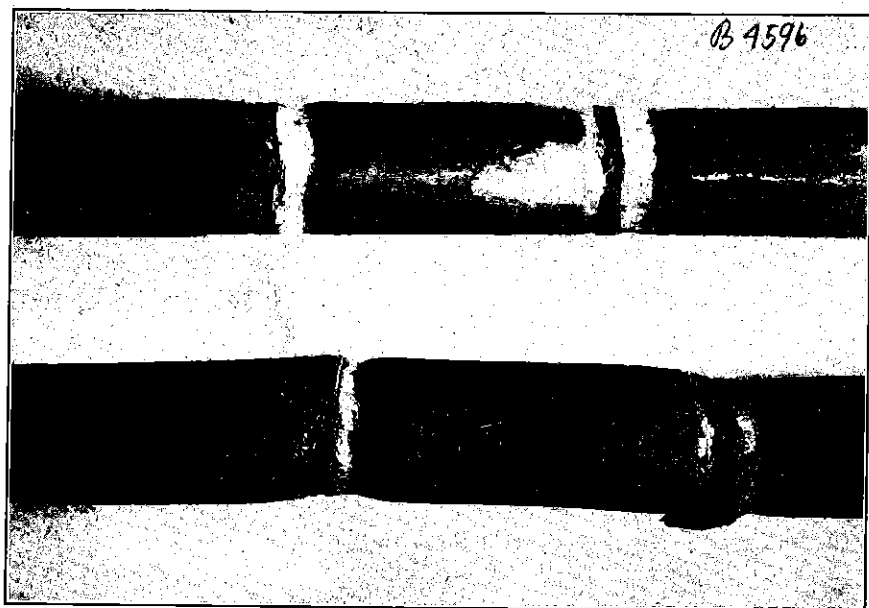


Fig. 2.

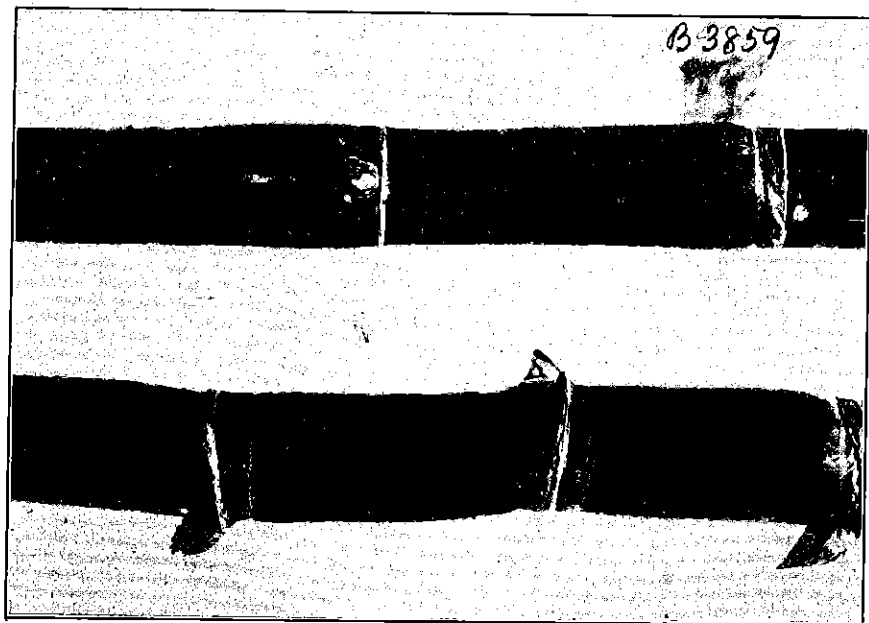


Fig. 1.

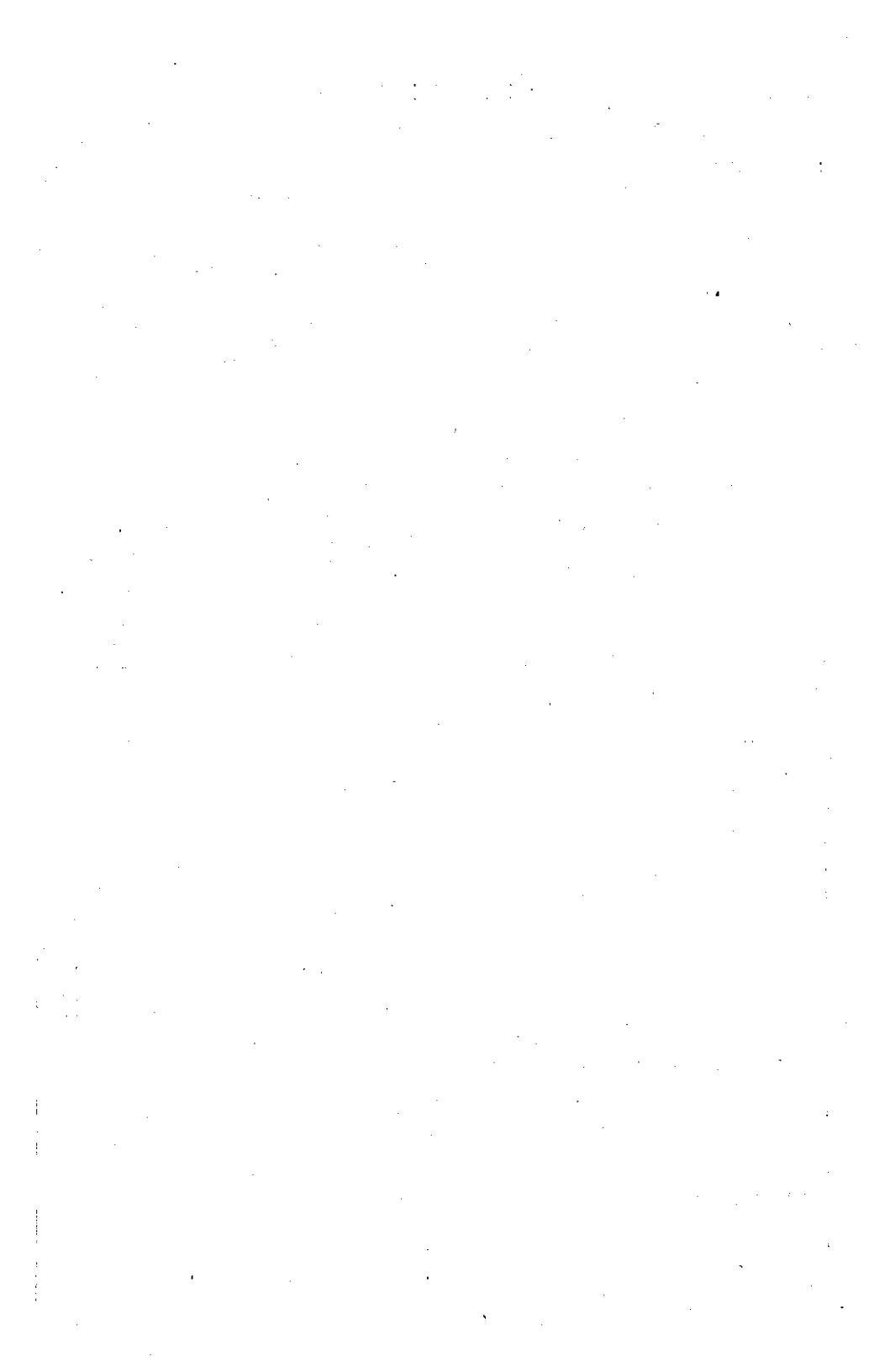
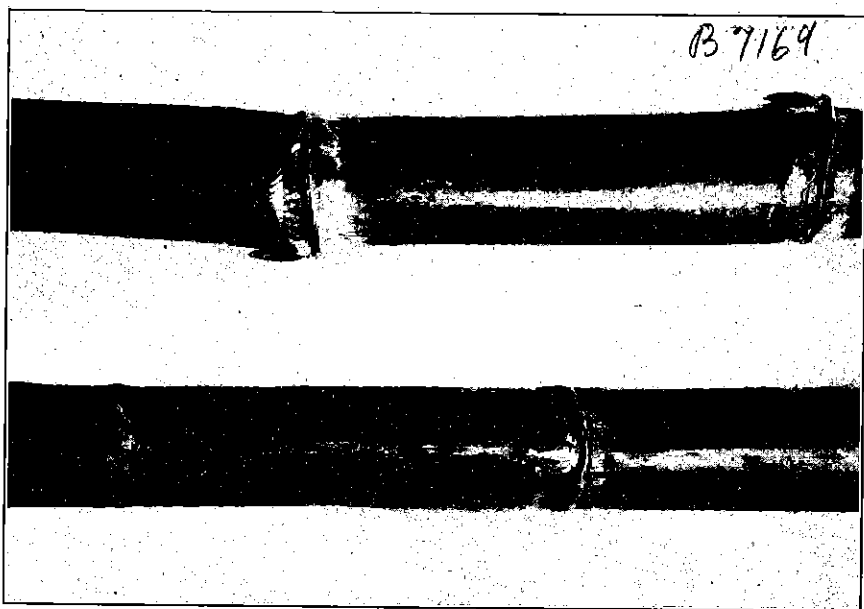
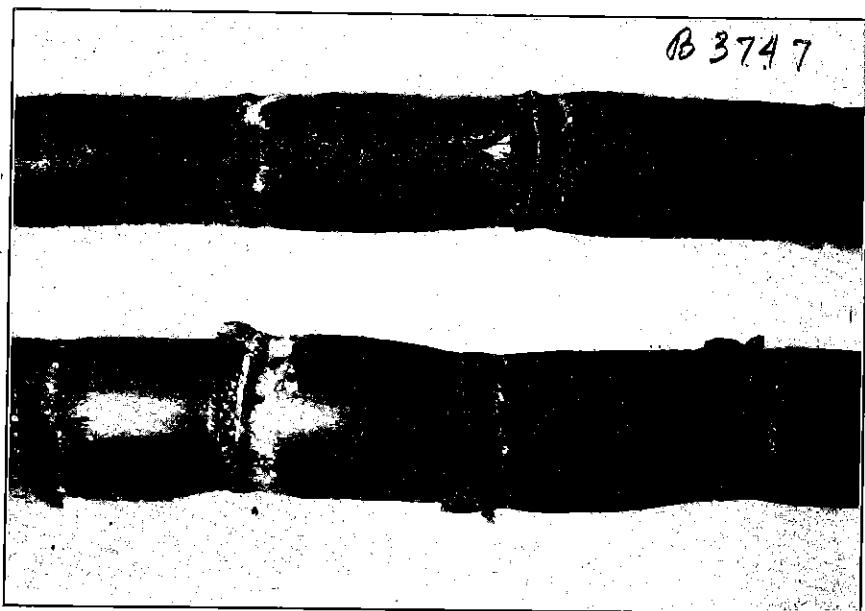


PLATE XVI.
SUGAR-CANE VARIETIES OF PORTO RICO.



✓
Fig. 2.



X
Fig. 1.

PLATE XVII.
SUGAR-CANE VARIETIES OF PORTO RICO.

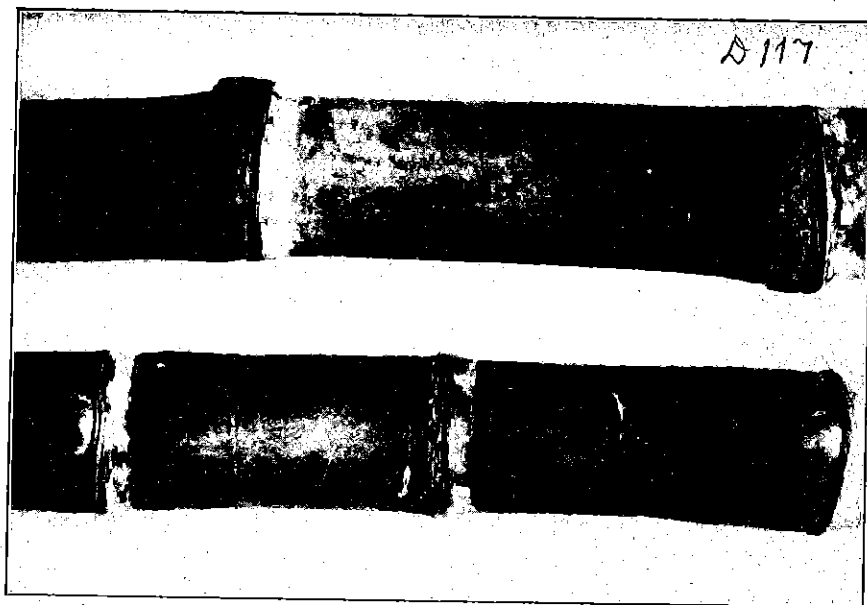


Fig. 2.

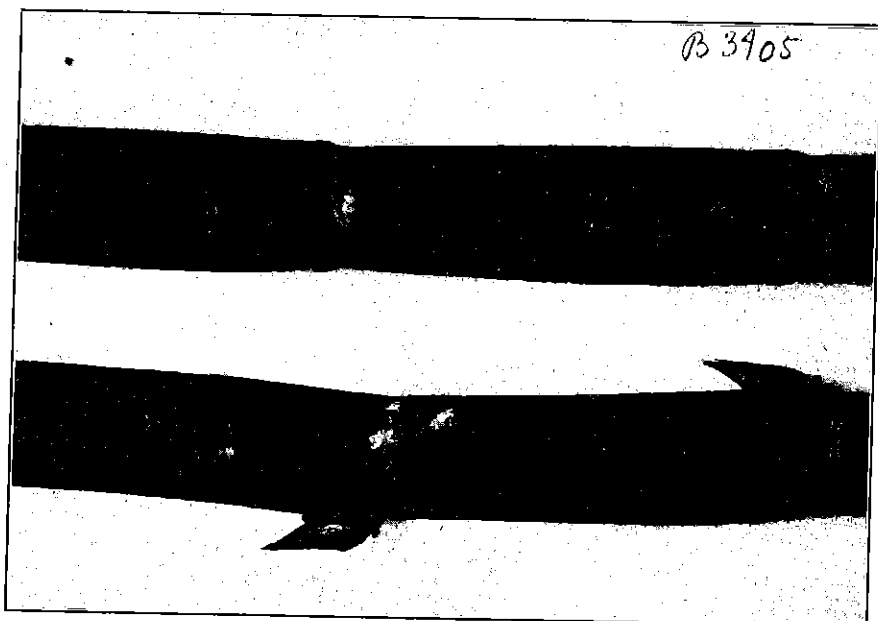


Fig. 1.

PLATE XVIII.
SUGAR-CANE VARIETIES OF PORTO RICO.

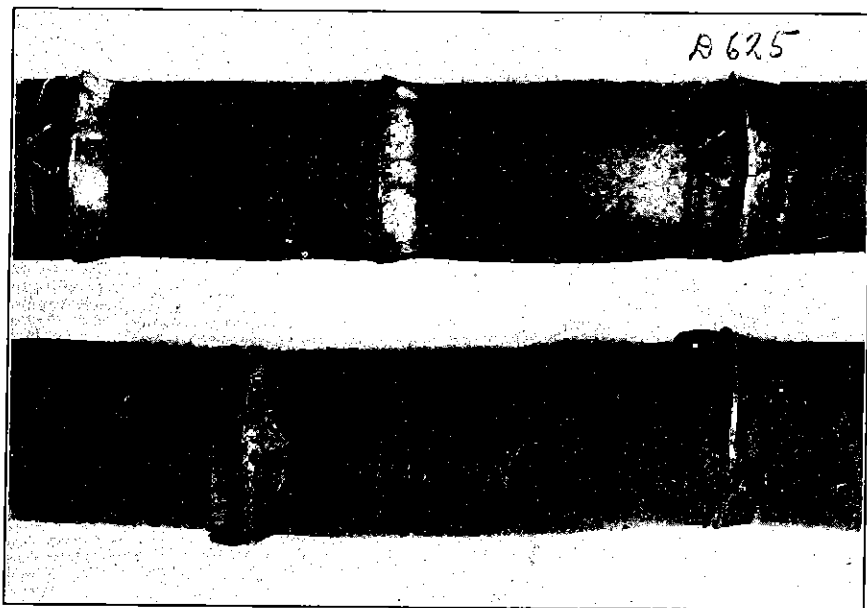


Fig. 2.

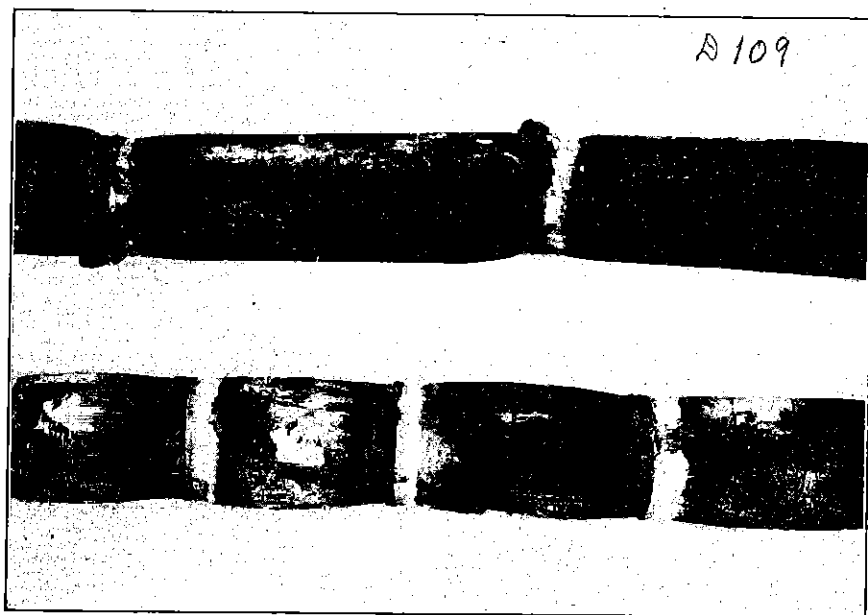


Fig. 1.

